Optimal exchange regime in a two sector open-economy

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Abstract

The present article deals with the issue of optimal degree of exchange rate flexibility. It departs from the current literature on the subject as it does not introduce nominal rigidities nor address the question of international monetary cooperation. Instead, the argument hinges on the economic structure of the economy. The existence of sectorial strategic interactions yields a welfare improving opportunity of coordination for monetary policy. Monetary policy can act as a weak-coordinating device by reducing the market power of the price setting agent. This is possible by linking the non-cooperative agents' decision to money supply (through a monetary rule). The smaller a sector, the larger its ability to set a high relative price without having to bear the bad consequences of it. As a result, the monetary rule must be more restrictive vis-à-vis small sectors. In a very open economy, that is, when the non-tradable sector is small, the monetary rule must mainly link a restrictive monetary policy to the relative price of the non-tradable sector. On the contrary, in a nearly closed economy where the tradable sector represents a small share of national production, a fixed exchange regime becomes more suitable since it allows to keep the relative price of the tradable sector under control by avoiding frequent currency depreciation. For intermediate degree of openness, a semi-flexible exchange rate regime is more suitable.

1 Introduction

Imperfect competition plays an important role in macroeconomic theory as it gives rise to an "aggregate demand externality" which allows welfare improving government interventions (see for instance Silvestre, 1993; Dixon and Rankin, 1994; Benassy, 1995). The implications of imperfect competition for an open economy have received less attention (see Dixon, 1994 for a recent survey). Our paper is a contribution to this issue. The aim of the present article is to compare different exchange rate regimes in a *long run* perspective, i.e. when all prices are flexible and the balanced trade condition holds.

The question may seem trivial since it is commonly argued that imperfect competition is not sufficient for monetary policy to generate real effects (see Blanchard and Kiyotaki, 1987). Instead, it is claimed that a second distortion (such as nominal rigidity) is required in addition to imperfect competition. However, we will show that, if there are strategic interactions based upon nominal variables, monetary policy, and in particular the choice of an exchange regime, can have real effects[1].

In short, the intuition behind this result is the following. When money supply is made responsive to strategic variables, it alters the structure of the strategic interaction faced by non-cooperative agents. More precisely, a monetary rule linking the money supply (and thus the nominal aggregate demand) to strategic variables is able to modify the elasticity of demand curves faced by sellers and reduce market power. As a result, monetary policy can have real effects.

In an open economy, monetary policy is closely related to the choice of an exchange regime. We treat this question in a simple model which has no pretence to generality but illustrates the general mechanism by which the choice of an exchange regime can improve welfare as soon as there are nominal strategic interactions. We operate in a small-open-economy-model with two sectors (a tradable and a non-tradable one) where the single source of market imperfection lies in the labour market: two sectorial monopoly unions set nominal wages[2]. Sectorial interactions in the process of wage setting have been acknowledged for a long time now (see among many others Oswald, 1979; Gylfason and Lindbeck, 1984). Other sources of market imperfection could have been added but it would have obscured the exposition of the main results.

We first focus on two polar monetary policies, namely, no monetary intervention at all by the central bank combined with exchange rate flexibility and, on the other hand, a totally fixed exchange rate without any further monetary intervention by the central bank. A fixed exchange regime is shown to lead to more wage restraint than a non-interventionist monetary policy simply targeting the money stock and letting the exchange rate clear the exchange market.

In a second stage, we show that an optimal flexibility of the exchange rate is inversely related to the size of the tradable sector, i.e. the degree of openness of the economy. That is, from a sectorial interaction point of view, the more open the economy, the more flexible its nominal exchange rate must be.

The paper is organized as follows. The next section presents the model. The general non-cooperative equilibrium is presented in a third section. The fourth section compares the pure flexible exchange regime to the fixed exchange regime. The fifth section determines the optimal

[1] It is important to note that this result does not hinge on a "strong coordination" failure, as e.g. in the "money as a sunspot" literature where money serves as a signal for choosing between Pareto-rankable non-cooperative equilibria (see Grandmont, 1989).

[2] Several general equilibrium models displaying union's wage setting or wage bargaining have been presented. See among others Gylfason and Lindbeck, 1984; Ellis and Fender, 1987; Jacobsen and Shultz, 1990; Dixon, 1990; Rasmussen, 1992 and Fender and Yip, 1994.

exchange regime inside the class of monetary rules proposed in the second section. The last section concludes the paper.

2 The Model

We consider a two sector small open economy with competitive goods markets where one non-tradable sector is totally sheltered from international competition while the tradable sector must take the international price as given. The focus will be on sectorial strategic interactions. To this end, we introduce two monopoly unions, each setting the nominal wage within their segment of the labour market. For the sake of clarity, we use the simplest possible macroeconomic model displaying strategic interactions between both unions. Accordingly, we assume (i) Cobb-Douglas technologies and preferences[3]; (ii) sectorial spillovers that are limited to the consumer price index spillover and to the usual macroeconomic budget constraints. Introducing less specific assumptions would not undermine the main conclusions/results but would make the exposition of the principal mechanism more obscure/difficult.

2.1 Firms

There is an identical representative competitive firm in each sector. The indices N and T stand, respectively, for the non-tradable sector and for the tradable sector. Production function is given by $Y_i = L_i^{\alpha}$, $0 < \alpha < 1$. Hence labour demand and good supply functions are given by

$$L_i = \left(\frac{W_i}{\alpha P_i}\right)^{-\frac{1}{1-\alpha}}, \tag{1}$$

$$Y_i = \left(\frac{W_i}{\alpha P_i}\right)^{-\frac{\alpha}{1-\alpha}}, \quad i = \{N, T\}. \tag{2}$$

2.2 Consumers

All workers have the same disutility of work (equals to v) and supply one unit of labour if real wage is larger than v. All consumers are risk-neutral[4] and derive the same utility from consumption:

$$u_j = K_u \left(\frac{M}{Q}\right)^{1-c} \left(C_N^{\delta} C_T^{1-\delta}\right)^{c} - v h_j$$

with $h_j = 1$ if consumer j is a worker and 0 otherwise. $0 < c, \delta < 1$. C_N and C_T are respectively the non-tradable and the tradable consumption goods. M is the nominal money holdings whose detention can be derived as a mixed indirect utility function or proxy for utility derived from future consumption. K_u is a normalization constant used to alleviate further notations and equals to $(1-c)^{c-1} c^{-c} \delta^{-\delta} (1-\delta)^{-(1-\delta)}$. Q is the true consumer price index given by:

$$Q = P_N^{\delta} P_T^{1-\delta}. \tag{3}$$

The aggregate nominal budget constraint is: $\Omega = M^{\circ} + Y$ where $Y = P_N Y_N + P_T Y_T$ stands for nominal national product. The aggregate demands can be derived as:

$$\begin{cases} M^d = (1-c)\Omega \\ C_N P_N = c\delta\Omega, \\ C_T P_T = c(1-\delta)\Omega. \end{cases} \tag{4}$$

[3] This assumption precludes any structural change in demand based on wealth effects.

[4] Introducing risk-aversion would not alter qualitatively the results.

2.3 Trade Unions

The labour market is segmented: The number of workers in each sector, and thus the supply of labour, is fixed and assumed to be larger than the demand for labour at all real wages larger than the marginal utility of leisure. All workers belonging to a particular sector are members of the corresponding sectorial trade union. The objective of union i is derived from the utilitarian aggregation of all union members' indirect utility function. Each union takes into account the real profits accruing to its members. We need a simple sharing rule for the profits of both sectors. Assuming that all profits are distributed to workers[5], we can set the following sharing rule: members of union i receive the share γ_i of profits from sector i and the share $\left(1-\gamma_j\right)$ from sector j. More precisely:

$$\Psi_i = L_i\left(\frac{W_i}{Q} - v\right) + \gamma_i \frac{\Pi_i}{Q} + (1-\gamma_j)\frac{\Pi_j}{Q}, \quad i \neq j \in \{N, T\}. \tag{5}$$

In order to simplify the analysis of the results, we assume that $\gamma_i = 1$ for both i. Hence there is no spill-over created by the profit distribution. However this assumption does not alter qualitatively the results of the paper.

Because of the Cobb-Douglas production function, sectorial profit share and labour share are constant so that real sectorial profits can be expressed as

$$\frac{\Pi_i}{Q} = \frac{1-\alpha}{\alpha}\frac{W_i}{Q}L_i.$$

Inserting this relation in the union objective function (5) leads to the following simplification:

$$\Psi_i = \frac{L_i}{\alpha}\frac{W_i}{Q} - vL_i \ , \quad i \in \{1, 2\}.$$

Simply, since profits also accrue to workers, the actual remuneration of one unit of labour is not W_i but $\frac{W_i}{\alpha}$.

Each union maximizes its objective for a given *nominal* wage of the other union. All other variables enter into the maximization. In particular, the effect of a nominal wage variation on the price index is taken into account by both unions. This assumption is reasonable as each sector is large enough to affect noticeably the price index when wages vary.

The maximization of the union objectives implies that the real consumption wage is a constant mark-up on the outside option, equal here to the marginal disutility of work v. This mark-up is determined by the elasticities of the two objectives pursued by the union (namely, real wage and employment) with respect to nominal wage:

$$\frac{W_i}{\alpha} = \left[1 + \frac{\epsilon[W_i/Q, W_i]}{\epsilon[L_i, W_i]}\right]^{-1} Qv \ , \ i = \{N, T\}$$

when elasticity of x with respect to y is represented by $\epsilon[x, y]$. Each of these two elasticities can be decomposed so as to distinguish real and nominal variables:

$$W_i = \left[1 + \frac{1 - \epsilon[Q, W_i]}{\epsilon[L_i, \frac{W_i}{P_i}]\left(1 - \epsilon\left[P_i, W_i\right]\right)}\right]^{-1} Qv\alpha \ , \ i = \{N, T\}. \tag{6}$$

[5] Assuming that some share of the profit accrues to a person of private means does not alter the general results of the paper. For instance if one capitalist (and non-worker) receives all profits, each union i maximizes its objective with $\gamma_i = 0$ and $\gamma_j = 1$.

The nominal wage is indexed on the consumer price. As will be seen later on, with the chosen specification, all elasticities entering equation (6) will be constant. It allows a great simplification of the analysis but any more complex framework displaying sectorial interactions would have been suitable too. The precise value of these elasticities still depends on the strategic behaviors of the unions (see section 3).

Equation (6) implies that both sectorial unions set their nominal wage so as to keep them indexed on the consumption price index. The wage indexation behavior is at the root of the strategic interactions. An exogenous wage change in one sector modifies the price index and generates a wage change in the other sector.

2.4 Current account

The balance of payment A is given by[6]:

$$\begin{aligned} A &= P_T Y_T - P_T C_T \\ &= P_T Y_T - c(1-\delta)\,\Omega \\ &= M^d - M^\circ = \Delta M. \end{aligned} \tag{7}$$

Hence, A is simply the variation in foreign reserves. Since we focus on long run relationships, we impose that $A = 0$. Hence, the money demand equals money supply $M^d = M^\circ = M$. This constraint can be met either by an exchange rate adjustment (in a "pure" flexible exchange rate regime), or by an adjustment in the money supplied by the Central Bank (in a fixed exchange rate regime) or even by a mixture of the two (in a flexible exchange regime).

Once the assumption of permanent balanced trade is made, the nominal national product and the nominal budget constraint can be expressed like

$$Y = \frac{c}{1-c} M, \tag{8}$$

$$\Omega = \frac{1}{1-c} M. \tag{9}$$

2.5 Monetary policy

We retain the following formulation for the money supply which links the nominal quantity of money to the nominal wage levels:

$$M = D^{1-\mu_N-\mu_T}\, W_N^{\mu_N} W_T^{\mu_T}. \tag{10}$$

This monetary rule is admittedly ad hoc: it is the simplest way to illustrate how a monetary rule (the parameters (μ_N, μ_T)) can have real consequences. It implies that the money supply is adjusted automatically to changes in nominal wage levels. But any more general formulation of the monetary rule linking the money supply to nominal variables would have been suitable. What matters is that money supply may be *in fine* linked to at least one strategic nominal variable of the model.

At this stage, μ_N and μ_T can take any (positive or negative) value. The larger the value of μ_i, the more accommodating the monetary policy. We introduce the exogenous factor D to

[6] The present model focus only on the real side of the economy. Financial flows are not take into account since this would require a full inter-temporal framework which falls out of the present issue.

allow for discretionary change in the money supply[7]. It will be shown later that the pure flexible and the fixed exchange rate regimes are special cases of (10).

We assume the monetary rule to be common knowledge and credible. In particular, both sectorial unions take the Central Bank's behavior into account when setting their nominal wages.

2.6 Market Clearing

For non-tradables, the price P_N clears the market whatever the exchange rate regime. With our specification, the market clearing price is a weighted average of the nominal aggregated demand and of the own sector nominal wage. More formally, it is easily shown that:

$$P_N = (c\delta\Omega)^{1-\alpha}\left(\frac{W_N}{\alpha}\right)^{\alpha}. \tag{11}$$

For tradables, the price is given by The Law of One Price: $P_T = eP^*$ with e the exchange rate and P^* is the (exogenous) foreign price expressed in foreign currency. That implies that any excess (respect. lack) of supply of national production over national consumption is exported (respect. imported). The balance of trade condition takes the following general formulation

$$C_T\left(eP^*, \Omega\right) = Y_T\left(W_T, eP^*\right). \tag{12}$$

Here, equation.(12) takes the following form:

$$c(1-\delta)\frac{\Omega}{eP^*} = \left(\frac{W_T}{\alpha eP^*}\right)^{\frac{-\alpha}{1-\alpha}}. \tag{13}$$

Because Ω is proportional to M (equation.(9)), the money supply and the exchange rate provide two alternative means to reach the trade balance condition (12).

We can distinguish two polar cases. On the one hand, we consider the case where the Central Bank let the exchange rate fluctuate freely in order to balance the current account and does not intervene at all ($\mu_N = \mu_T = 0$ and $D = \overline{D}$). This case refers to an orthodox monetarist policy targeting only on the money stock. In this case, the exchange rate (and the price for tradables) balancing the current account is given by:

$$P_T = eP^* = \left(c(1-\delta)\overline{\Omega}\right)^{1-\alpha}\left(\frac{W_T}{\alpha}\right)^{\alpha}. \tag{14}$$

This equation is obviously symmetrical to (11) except that Ω takes a fixed exogenous value $\overline{\Omega}$ because in a pure flexible exchange regime $M = \overline{D}$ (as both $\mu_i = 0$) with $\overline{D}$ exogenous.

On the other hand, we consider the fixed exchange regime case where the Central Bank intervention serves only the latter objective. In this case the focus is on external price stability and the money stock becomes endogenously determined by the trade balance condition (equation.(12)). With a fixed exchange rate, $P_T = \overline{e}P^*$ is exogenous and the current account balances through variations in the money supply occurring naturally with a specie-flow mechanism.

The money supply that balances the current account is:

$$M = \frac{1-c}{c\,(1-\delta)}\left(\overline{P}_T\right)^{\frac{1}{1-\alpha}}\left(\frac{W_T}{\alpha}\right)^{-\frac{\alpha}{1-\alpha}}. \tag{15a}$$

[7] The exponent of D is meaningless since D is fully exogenous. It simply implies that all nominal variables will be linearly homogeneous in D wich avoids misleading interpretation on the role it plays in the model bu it is by no mean necessary for money neutrality.

Equation (15a) corresponds to the general monetary rule pattern when $\mu_N = 0$, $\mu_T = -\frac{\alpha}{1-\alpha}$ and $D = \left(\frac{1-c}{c(1-\delta)}\right)^{1-\alpha} \overline{P}_T \alpha^\alpha$ with $\overline{P}_T = \overline{e}P^*$. Therefore, the discretionary money supply (D) determines the *level* of the fixed exchange rate while the monetary rule (μ_N, μ_T) allows the fixity of the exchange rate when nominal wages vary. It shows that in a fixed exchange regime there exists a necessary link between money supply and endogenous nominal variables. Note that, as usual, monetary policy is fully endogenized when the exchange rate must be kept constant, that is, both μ_i and D must take a particular value associated with a particular level of the exchange rate.

The fact that the monetary authorities let the money supply depend on nominal wages should not be surprising. Besides the fact that it follows naturally from the imposition of a fixed exchange rate under balanced trade, it also seems to fit observation. A possible example of that is the timing of announcements by the German Central Bank when the largest trade union (IG-Metal) bargains over its future nominal wage increases. Letting know that a wage increase in the tradable sectors will trigger a restrictive (or a least a non-accommodating) monetary policy may dissuade the unions in those sectors to have important wage claims. As this sector plays a leading role in wage formation, the monetary authorities have a strong incentive to link a restrictive monetary policy to this sector's wage level.

It is important to note that in the present model, the money *stock* is neutral (though the monetary *rule* is not as will become clear in the next section). The following proposition clarifies this important point.

Proposition 1 *Whatever the exchange regime, money is neutral as all nominal variables are linearly homogeneous in the money stock (D or M).*

This can be checked by looking at the non-cooperative equilibrium which is described by a system of 7 endogenous variables $(W_N, W_T, Q, M, \Omega, P_N, P_T)$, one exogenous variable (D) and 7 log-linear equations expressing the endogenous variables as a function of D: (3)-(6)-(9)-(10)-(11)-(13). This system is clearly linearly homogeneous in D irrespectively to the monetary rule. That means that a change in (the exogenous component of) the money stock always implies a proportional currency depreciation (irrespective of the exchange regime[8]) which does not affect the real state of the economy.

In particular, equation (13) can be replaced by equation.(14) in a pure flexible exchange regime and by equation.(15a) in a fixed exchange regime. In these two polar cases, one endogenous variable is not related to the others but is defined exclusively in term of the exogenous component of the money stock D: M in the flexible regime (with $\overline{M} = D$) and P_T in the fixed exchange regime (with $D = \left(\frac{1-c}{c(1-\delta)}\right)^{1-\alpha} \alpha^\alpha \overline{P}_T$).

3 Non-cooperative outcome

In order to determine the real wages set by unions in both sectors we need to determine the value of the three elasticities entering in equation.(6). We do that for the general monetary rule presented in the preceding section. The general solution will allow us to discuss the case of intermediate exchange regimes after having presented the two 'pure' regimes in the next section.

[8] In a fixed exchange regime this is true as long as all economic agents are (still) persuaded to behave in a fixed exchange regime!

The elasticity of labour demand with respect to real wage is given by the production function relation and is independent of the money supply:

$$\epsilon[L_i, \frac{W_i}{P_i}] = \frac{-1}{1-\alpha}.$$

The other two elasticities depend on the monetary rule that affects nominal variables. Using the equation of money supply (equation.(10)) to eliminate financial wealth Ω in the price equations (11) and (13), one gets:

$$P_N = \alpha^{-\alpha}\left(\frac{c\delta D}{1-c}\right)^{1-\alpha} W_N^{\alpha+(1-\alpha)\mu_N} W_T^{(1-\alpha)\mu_T} \tag{16}$$

$$P_T = eP^* = \alpha^{-\alpha}\left(\frac{c(1-\delta)D}{1-c}\right)^{1-\alpha} W_N^{(1-\alpha)\mu_N} W_T^{\alpha+(1-\alpha)\mu_T}. \tag{17}$$

These equations show that the ability of a union to pass a nominal wage increase onto its output price depends on the monetary rule. This ability is crucial since it determines the labour demand elasticity to a nominal wage variation. Inserting equation.(16) and (17) in labour demand for, respectively sector N and T, leads to:

$$L_N = \frac{\alpha c\delta}{1-c} D\, W_N^{-1+\mu_N} W_T^{\mu_T} \tag{18}$$

$$L_T = \frac{\alpha c(1-\delta)}{1-c} D\, W_N^{\mu_N} W_T^{-1+\mu_T}. \tag{19}$$

The monetary policy can weaken or tighten the labour demand constraint faced by a union when it sets its nominal wage. In a fully flexible exchange regime (i.e. without a coordinating monetary rule) ($\mu_N = \mu_T = 0$), the labour demand elasticity is simply equal to -1 in both sectors and labour demand is not affected by the wage level in the other sector.

In a fixed exchange regime, $\mu_T = -\frac{\alpha}{1-\alpha}$ in order to keep the exchange rate and P_T constant (see equation.(15a)). This implies that the elasticity of labour demand (equal to $\frac{-1}{1-\alpha} < -1$) is larger (in absolute value) than in the non-tradable sector where $\mu_N = 0$. Therefore, a negative μ_T strengthens the trade-off between nominal wage and employment faced by the union in the tradable sector and reduces its wage claims.

In order to get the third elasticity linking the price index to nominal wages, we insert equation.(16) and (17) in (3). It leads to[9]:

$$Q = K_Q\ D^{(1-\alpha)(1-\mu_N-\mu_T)} W_N^{\alpha\delta+(1-\alpha)\mu_N} W_T^{\alpha(1-\delta)+(1-\alpha)\mu_T}. \tag{20}$$

The effect of a nominal wage rise on Q can be decomposed in two parts which become more apparent if equation (20) is written in distinguishing cost push inflation from demand pull inflation. Letting $\overline{W} = W_N^{\delta} W_T^{1-\delta}$ be the average nominal wage in the economy, the general price level can be expressed like:

$$Q = K_Q\ \overline{W}^{\alpha} M^{1-\alpha} \tag{21}$$

First, a change in nominal wages implies a direct price increase through a rise in goods supply curves. The second effect arises because of the link between the nominal wage and the money supply. The less restrictive a monetary rule is, that is the larger μ_i is, the larger is the price index repercussion of a nominal wage increase.

[9] With $K_Q = \alpha^{-\alpha}\left(\frac{c}{1-c}\delta^{\delta}\,(1-\delta)^{1-\delta}\right)^{1-\alpha}$.

This is illustrated by table 1 that describes the train of events following a relative nominal wage change in sector T ($\frac{dw_T}{w_T} = \widehat{w}_T$). The same relations hold for the non-tradable sector by replacing $(1-\delta)$ by δ and μ_T by μ_N.

Table 1

$$\begin{array}{|lccc|}
\hline
\widehat{w}_T \rightarrow & \widehat{\Omega} = \widehat{M} = \mu_T \; \widehat{w}_T & \rightarrow & \widehat{p}_N = (1-\alpha)\mu_T \; \widehat{w}_T \\
\searrow & \downarrow & & \downarrow \\
& \widehat{p}_T = (\alpha + (1-\alpha)\mu_T) \; \widehat{w}_T & \rightarrow & \widehat{q} = (\alpha(1-\delta) + (1-\alpha)\mu_T) \; \widehat{w}_T \\
\hline
\end{array}$$

A nominal wage rise affects the tradable goods market by two channels. There is an upward effect on the supply curve (α) and a downward or upward effect (depending on the sign of μ_T) on the demand curve via the monetary rule. Table 1 shows clearly that the two polar exchange regimes correspond to a cancellation of one of the two channels. In a purely flexible exchange regime ($\mu_T = 0$), only the effect on the supply curve prevails. At the other extreme[10], in a fixed exchange regime ($\mu_T = \frac{-\alpha}{1-\alpha}$), the effect on the demand curve exactly outweighs the move in the supply curve for tradable goods so that its price is unaffected. Hence, 0 and $\frac{-\alpha}{1-\alpha}$ constitutes two plausible extreme values for both μ_i.

Table 2 summarizes the different elasticities needed to compute the non-cooperative equilibrium real wages.

Table 2

	L_1	Q	L_2
W_1	$-1+\mu_N$	$\alpha\delta + (1-\alpha)\,\mu_N$	μ_N
W_2	μ_T	$\alpha(1-\delta) + (1-\alpha)\,\mu_T$	$-1+\mu_T$

Introducing these elasticities in the real wage equations (6) leads to the following non-coordinated real outcomes (R^{nc})[11]:

$$R_N^{nc} = \frac{W_N}{Q} = v\frac{1-\mu_N}{\delta-\mu_N} \tag{22}$$

$$R_T^{nc} = \frac{W_T}{Q} = v\frac{1-\mu_T}{1-\delta-\mu_T}. \tag{23}$$

This solution shows clearly that the monetary rule affects the desired nominal wage for a given nominal wage in the other sector and thus affects real wages.

In the pure flexible exchange regimes $\mu_N = \mu_T = 0$, while in the pure fixed exchange regime, $\mu_N = 0$ and $\mu_T = \frac{-\alpha}{1-\alpha}$. Therefore the non-coordinated (nc) real wage in the sheltered sector is independant of the exchange rate regime and is equal to

$$R_N^{nc} = \frac{v}{\delta}. \tag{24}$$

[10] Note that for non-tradable goods, $\mu_N = 0$ in the two polar exchange regimes.

[11] In order to get real wages larger than ν, we impose $\mu_N < \delta$ and $\mu_T < (1-\delta)$. We could also accept values of $\mu_N > \frac{1-\alpha\delta}{1-\alpha}$ and $\mu_T > \frac{1-\alpha(1-\delta)}{1-\alpha}$ but this would imply that a nominal wage *increase* yields a *reduction* in consumer wage. Intuitively, the limit case $\mu_1 = \delta$ and $\mu_2 = (1-\delta)$ implies a constant real money stock. This means that there is no deflationary effect on nominal aggregate demand when Q increases. Hence, there is no restraining force on nominal wage increase and the Nash equilibrium in nominal wages goes to infinity. For larger values of μ_1 and μ_2, the Nash equilibrium does not necessarily exists or it leads to negative consumer wages.

On the contrary, the real wage in the tradable sector is altered by the exchange regime. Replacing μ_T by its corresponding value in each pure exchange regime, one gets:

$$R_T^{ncflex} = \frac{v}{1-\delta} \tag{25}$$

$$R_T^{ncfix} = \frac{v}{1-\delta(1-\alpha)}. \tag{26}$$

It can easily be checked that the real wage for the tradable sector is always smaller with a fixed exchange rate. The gap between both solutions increases with α. The reason is that α represents the proportion in which a nominal wage increase is transferred onto the corresponding output price in a flexible exchange regime (see equation.(17)). With a fixed exchange regime this opportunity disappears (whatever α) for the tradable sector. Hence, the effect of the output price rigidity on the real wage is stronger when α is large.

The reduction in the tradable sector's real wage is always welfare improving. National welfare Φ is the sum of all consumers' indirect utility less total disutility of labour:

$$\Phi = \Omega/Q - (L_N + L_T)v.$$

Φ can be expressed as a function of both real wages[12]. As long as both real wages are higher than their competitive value (equal to v), a reduction in one of them is bound to lead the economy closer to its maximum welfare level. Indeed, as long as the utility gain brought about by additional production is smaller than the disutility of labour needed to produce it, reduction in real wages implies welfare improvement.

Proposition 2 *When there are strategic interactions bearing on nominal variables, the choice of the exchange regime affects real variables. Compared with a pure flexible exchange regime (where monetary authorities do not intervene at all), a fixed exchange regime improves national welfare.*

Unions' market power is one way to explain the Pareto sub-optimality of the non-cooperative equilibrium. Another way to put it is in term of harmful strategic interaction: the non-cooperative solution leads to a sub-optimal outcome because there are sectorial spillovers. Each sector is able to transfer some of the bad consequences of a nominal wage rise on the other sector's consumers through an output price increase. The non-coordinated outcome leads to bad macroeconomic results when both sectors have a large free-riding opportunity. In this case, there is a nominal wage overbidding which is globally hurting both unions. Before presenting the cooperative outcome as point of comparison, we can show the consequence in terms of strategic interactions of the choice of exchange rate regime.

In a pure flexible exchange regime both nominal wages are *strategic complements*. This flows from the real wage rigidity and from the particular value of taken by Q in this case:

$$Q = K_Q W_N^{\alpha\delta} W_T^{\alpha(1-\delta)} \tag{30}$$

[12] Employment and $\frac{\Omega}{Q}$ are negative functions of both consumer wages.

$$L_N = \alpha^{\frac{1}{1-\alpha}} \left(\frac{\delta}{1-\delta}\right)^{1-\delta} R_N^{-\frac{1-\alpha(1-\delta)}{1-\alpha}} R_T^{\frac{-\alpha(1-\delta)}{1-\alpha}} \tag{27}$$

$$L_T = \alpha^{\frac{1}{1-\alpha}} \left(\frac{1-\delta}{\delta}\right)^{\delta} R_N^{-\frac{\alpha\delta}{1-\alpha}} R_T^{-\frac{1-\alpha\delta}{1-\alpha}}. \tag{28}$$

$$\frac{\Omega}{Q} = \alpha^{\frac{\alpha}{1-\alpha}} \left(c\left(\frac{\delta}{s_N}\right)^{\delta}(1-\delta)^{(1-\delta)}\right)^{-1} \left[R_N^{\delta} R_T^{1-\delta}\right]^{\frac{-\alpha}{1-\alpha}}. \tag{29}$$

which simply follows from the general equation (21) when aggregate demand is independent of nominal wages. To keep its consumption wage constant, both unions must follow any nominal wage increase by the other union. A rise in δ affects the two reaction functions oppositely. It induces a stronger strategic complementarity for union T and conversely for union N. The smaller a sector, the stronger can it react by a similar move to the other union's wage increase (without having to fear a large index price repercussion). This feature will have important consequences when we envisage the optimal exchange regime at the end of this paper.

It is important noticing that, in a flexible exchange regime, the two sectors are symmetrical and they enter symmetrically in Q, at the exception of their size. Each sectorial union has the same ability to transfer a nominal wage increase into its output price. In the case of the tradable sector union, this occurs through a depreciation of the national currency. The symmetry follows because on the one hand, both sectors' fundamentals are identical (i.e. similar technologies and similar consumer preference for each sectorial goods) and on the other hand, both sectorial parameters of the monetary rule are the same ($\mu_N = \mu_T = 0$). As this latter characteristic will disappear in a fixed exchanged regime, so will the sectorial symmetry.

A fixed exchange regime reduces the strategic complementarity for the tradable sector and replaces strategic complementarity by strategic substitutability for the non-tradable sector. In a fixed exchange regime, the price index Q is given by

$$Q = \left(\frac{\delta}{1-\delta}\right)^{(1-\alpha)\delta} \left(\frac{W_N}{W_T}\right)^{\alpha\delta}. \tag{31}$$

In a fixed exchange regime, the non-tradable wage becomes a strategic substitute to the nominal wage in the tradable sector. Any increase in W_T tends to create a current account deficit which is compensated by a deflationary monetary policy in order to reduce the national demand for tradables. The deflationary policy yields a reduction in demand for non-tradables. This in turn provokes a reduction in P_N and in Q. Confronted to this reduction for its good demand, and because it wants to keep its consumption wage constant, the non-tradable sector's union must react by *reducing* its nominal wage.

On the contrary, W_T is still a strategic complement of W_N as an increase in the latter implies a rise in the index price Q. However, the strategic complementarity for W_T is reduced under a fixed exchange regime because an increase in W_T implies a fall in the index price Q. Hence a nominal wage increase is more effective to raise real wage.

The welfare improving coordination role of the exchange regime can be explained by the reduction in the strategic complementarity induced by a fixed exchange rate. The wage overbidding is reduced by preventing the non-tradable sector to follow wage increases in the tradable sector and by reducing the strategic complementarity of this sector.

Any cooperative outcome leads to the full internalization of the sectorial spill-overs and we can use it as a point of comparison. An (interior) cooperative outcome must satisfy the first order condition imposing the tangency of each union's indifference curves. In the present case, this condition yields a linear locus:

$$v = \delta R_N + (1-\delta) R_T. \tag{32}$$

As both real wages must be larger than (or equal to) the (marginal) disutility of labour v, the only possible cooperative outcome is $R_N = R_T = v$. This unique cooperative solution obviously yields the maximum national welfare level as it corresponds to the Walrasian equilibrium.

The gain of *cooperation*[13] is the welfare gap between, on the one hand, the non-coordinated outcome and, on the other hand, a centralized wage setting (Φ^*). We compare the welfare gains in both exchange regimes. That is, we compute the following ratio which represents the relative *coordination* gain following a change from a pure flexible exchange regime to a fixed exchange regime:

$$\frac{\Phi^{fix} - \Phi^{\circ}}{\Phi^{*} - \Phi^{\circ}}$$

with Φ° (respectively Φ^{fix}), the welfare level without any active monetary rule (respect. in a fixed exchange regime). Figure 1 shows this ratio for δ and α ranging from 0.1 to 0.9.

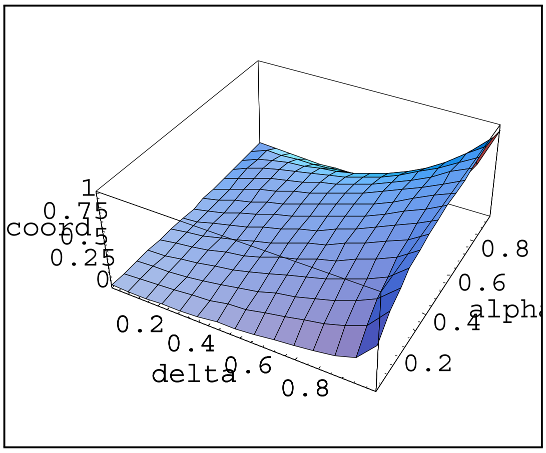

Figure 1: Relative welfare coordination gain.

Proposition 3 *The welfare improving effect of a fixed exchange regime increases as the economy becomes less open. For a (nearly) closed economy, a fixed exchange rate regime allows national welfare to reach its (global) maximum value.*

That means that in a (nearly) closed economy, all sectorial spillovers are internalized. The union in the encompassing non-tradable sector bears (almost) all the negative consequences of an output price increase as the non-tradable goods constitutes almost all its members' consumption. That is, the benefits of a relative price change are tiny for the large non-tradable sector. As a result, the wage in the large non-tradable sector keeps moderate (see equation.(24)).

Instead, the share of tradables in national demand is limited. It implies that the union in the tradable sector largely benefits from a increase of its relative output price (through a devaluation) as it provokes only a small change in the price index. Therefore the tradable union has a strong incentive to set a high nominal (and real) wage. In a fixed exchange regime, this opportunity is no more available to the union in the tradable sector and its nominal and real wages are lower (compare the real wages (25) and (26)).

In the opposite case (very open economy), the small non-tradable sector's union is not affected by the fixed exchange rate. Its ability to transfer its nominal wage increase onto its output price is not altered: its market power and its real wage are independent of the exchange

[13] More acurately, and according to (Silvestre, 1993), one should talk about gain of cooperation rather than gain of coordination.

regime[14]. Therefore, when the economy is constituted of an encompassing tradable sector, the fixed exchange regime is unable to restrain the wage setting in the non-tradable sector. This explains why welfare gain is monotonically increasing in δ for all α values.

For extreme value of α the welfare gap between both exchange regimes disappears. For $\alpha \to 0$, goods supply curves are vertical and variation in the wages have no effect on the output price. That means that the sectorial spillover disappears too as Q becomes independent from both nominal wages. Hence, using a restrictive monetary rule to reduce the price elasticity with respect to nominal wage becomes meaningless. On the other hand, when the marginal productivity of labour is constant ($\alpha \to 1$), the monetary rule (i.e. the exchange regime) does not affect the strategic interaction anymore: a change in aggregate demand does not affect output prices since supply curves are elastic (output price is a constant mark-up over nominal wage). This can be seen in equation.(17): with $\alpha \to 1$, the μ_i parameters do not play any role.

4 Targeting monetary restrictiveness

In the present context, monetary policy cannot replace intersectorial cooperation because it cannot cancel the negative sectorial spillovers. To see that, it suffices to remember that in the absence of any sectorial spillover, the non-cooperative outcome would be Pareto optimal. This comes down to setting both real wages to v. Looking at equations (22) and (23), it appears that this is possible only when the monetary rule becomes infinitely restrictive, i.e. both $\mu_i \to -\infty$. That is, any nominal wage rise would trigger a full contraction of the money stock which implies the end of "nominal" strategic interactions!

Hence, a full coordination of the non-cooperative equilibrium, i.e. leading to the Walrasian and cooperative outcome, is beyond the reach of a monetary policy, at least in the present setting. Indeed, allowing for e.g. inelastic labour supply would lead to an optimal monetary rule with finite μ_i parameters. In that case, full employment can be reached at higher real wages than the reservation wage v.

Moreover, there is a major problem associated with a restrictive monetary policy which is not taken into account in the present setting. It is the existence of nominal rigidities, at least in the short run. With such rigidities, a reduction in the money stock would entail negative real effects, contrarily to the present framework. Hence, in this richer context, there is a trade-off between the beneficial structural (or long term) role for a coordinating monetary rule and the short term negative effects due to nominal rigidities. That is, very restrictive monetary policies are not very relevant.

Hence, we will let aside the discussion of an optimal monetary rule since the present context is by far to simple to give rise to robust conclusions on this matter. Instead, we reason for a given level of monetary restrictiveness. Because a restrictive monetary policy has a welfare cost when there are nominal rigidities, it is important to target the monetary restrictiveness efficiently. We first define a measure of monetary restrictiveness. Then, we propose a plausible optimal degree of monetary restrictiveness which is used in the rest of the analysis in order to facilitate the process. But several observations comfort this choice. The most efficient way to target a given level of monetary restrictiveness is presented using this plausible optimal degree of monetary restrictiveness.

Welfare improvement in a fixed exchange regime is due to the reduction in the strategic complementarity in the wage setting process for both unions. As both unions choose their

[14] This results from $\mu_N = 0$ in both exchange regimes described so far. It would not be true if $\mu_N \neq 0$.

nominal wage so as to keep their real wage constant, in the absence of an active monetary rule, an exogenous nominal wage increase in one sector yields a price index increase and consequently a nominal wage rise in the other sector. This in turn has a price index repercussion and trigger a nominal wage response by the first union, and so on. As both real wages remains constant, relative wages are not altered by this wage overbidding. It means that the total effect on the price index (and on both nominal wages) following an exogenous wage variation is best rendered by the degree of homogeneity of Q with respect to both nominal wages (hereafter called h). According to equation.(20), it is equal to

$$h = \alpha + (1-\alpha)(\mu_N + \mu_T). \tag{33}$$

As seen in (33), what matters is the *sum* of both μ_i. The latter can be chosen as a proxy for the "monetary restrictiveness" (hereafter called $\sigma = \mu_N + \mu_T$).

The fixed exchange regime corresponds to a more restrictive monetary policy ($\sigma = -\frac{\alpha}{1-\alpha}$) and leads to less wage overbidding ($h = 0$) than a pure flexible exchange regime whose monetary restrictiveness is approached by $\sigma = 0$ and wage overbidding is summarized by $h = \alpha$. A fixed exchange regime leads to better welfare results because the monetary policy precludes *all* the wage overbidding. Indeed, homogeneity of degree 0, as in the fixed exchange regime, means that a general wage rise would have no price index repercussion. This suggests that $\sigma = -\frac{\alpha}{1-\alpha}$ corresponds to a plausible degree of monetary restrictiveness since it leads to null homogeneity of Q with respect to both wages.

Now, a fixed exchange regime is one way among many others to obtain homogeneity of degree 0 in both wages. Any other equally restrictive monetary rule such that $\sigma = \mu_N + \mu_T = -\frac{\alpha}{1-\alpha}$ would be convenient. What would be the best way to lead a restrictive monetary policy leading to homogeneity of Q of degree zero? In other words, what would be the best values for both μ_i such that $\sigma = -\frac{\alpha}{1-\alpha}$?

Let us first identify the possible candidates for the most efficient monetary rule among null homogeneity monetary rules. In section 3, we have shown that 0 and $\frac{-\alpha}{1-\alpha}$ constitute plausible bounds for each μ_i. These bounds correspond to polar cases concerning the sensibility of the supply and demand curves to a nominal wage change. For $\mu_i = 0$, the supply curve of good i shifts upward but the demand curve for good i does not react when W_i varies. In this case the price elasticity of good i to a wage change is equal to α. The opposite prevails for $\mu_i = \frac{-\alpha}{1-\alpha}$: the shift of the supply curve is exactly compensated by a downward move of the demand curve due to the restrictive monetary rule. In that case, the price elasticity is zero.

On the other hand, it seems natural to exclude positive μ_i as it would imply that any wage increase in sector i is encouraged by an aggregate demand inflation. This would enhance the market power of union i, which is counter productive. Then, the two extreme combinations (μ_N, μ_T) inside the null homogeneity condition (if we reject positive μ_i) are equal to $(0, \frac{-\alpha}{1-\alpha})$ in the one hand, and to $(\frac{-\alpha}{1-\alpha}, 0)$ in the other. These two polar cases correspond to the intuitive bounds previously defined, which comforts the intuition for excluding positive μ_i.

The first possibility (i.e. $(\mu_N, \mu_T) = (0, \frac{-\alpha}{1-\alpha})$) corresponds to the fixed exchange regime. The second case (i.e. $(\mu_N, \mu_T) = (\frac{-\alpha}{1-\alpha}, 0)$) leads to a flexible exchange regime where the price of non-tradables is independent of the wage in the non-tradable sector. This is possible because a wage increase in the non-tradable sector triggers a reduction in the money stock that curtails aggregate demand. As a result, a nominal wage rise in the non-tradable sector provokes a trade *surplus* that must be compensated for by an exchange rate appreciation. On the other hand, the consequence of a wage rise in the tradable sector is a loss of competitiveness which is alleviated by a currency depreciation. In this case, the exchange regime corresponds to a "managed float" situation: monetary authorities provoke a currency appreciation when wage increases in the non-tradable sector (and this prevents a wage rise in the tradable sector) but allows a depreciation when competitiveness of the tradable sector is jeopardized by a wage rise in this sector. Since this case is symmetrical to the fixed exchange rate, it leads to best welfare results when the economy is almost fully open, i.e. when the share in national demand of the tradable sector comes close to 1.

Intermediate monetary rules are also possible. Among them, one can find the following monetary rule: $\mu_N = \frac{-\alpha\delta}{1-\alpha}$ and $\mu_T = \frac{-\alpha(1-\delta)}{1-\alpha}$. This monetary rule has the ability to remove any strategic interaction, i.e. nominal wages are no longer strategic complement nor substitute. That is, the elasticity of Q with respect to each nominal wage becomes null. Hence, a nominal wage change in one sector does not trigger a price index increase and a subsequent wage rise in the other sector. Note however that this does not imply that the sectorial spillovers disappear because the sectorial negative externality through aggregate demand remains.

It is interesting to note that the non-coordinated equilibrium real wages obtained by this particular monetary rule correspond to the non-cooperative real wages in case of automatic indexation. Indeed, when a union maximizes its utility for a given *real* wage for the other sector[15], she ends up with the same real wage she would have obtained with the monetary rule just defined, i.e.

$$R_N^{index} = v\frac{1-\alpha(1-\delta)}{\delta} \tag{34}$$

$$R_T^{index} = v\frac{1-\alpha\delta}{1-\delta}. \tag{35}$$

That means that an automatic indexation clause brings a welfare improvement as a restrictive monetary policy since it prevents all nominal wage overbidding by the sectorial unions. But on the other hand, an automatic indexation clause leads to removing any real effect to monetary policy. This shows up in the fact that the non-cooperative real outcome with automatic indexation is independent from the parameters of the monetary rule. Monetary policy needs *nominal* strategic interactions to be effective. A monetary rule cannot affect strategic interactions based upon real variables as is the case with an automatic indexation clause[16].

We have already said that setting μ_T at $\frac{-\alpha}{1-\alpha}$ leads to better welfare result when the tradable sector is small. This suggests that the reason why a fixed exchange regime may not always represent the best monetary rule inside the class considered. The smaller a sector, the stronger is its strategic complementarity and the higher are its nominal and real wages. Hence, in order to prevent a harmful wage overbidding, a restrictive monetary rule must concentrate on the smallest sector. That is, monetary supply must react negatively mainly to wage change in the smallest sector.

More formally, let us call η the share of $\sigma = \mu_N + \mu_T$ linking the wage in sector N: $\eta = \frac{\mu_N}{\sigma}$. The question is to maximize national welfare with respect to η for a given σ. The answer to this problem is $\eta = 1 - \delta$: the monetary rule must target a particular sectorial nominal wage proportionately to the size of the other sector. The intuition is simply that a small sector has larger opportunity to manipulate the sectorial relative output price to its advantage. Hence, a deflationary monetary policy must mainly target the small sector's wage.

If the monetary policy must be as restrictive as the one exerted with a fixed exchange regime, that is, $\mu_N + \mu_T = \frac{-\alpha}{1-\alpha}$, the best monetary rule in term of welfare is $\mu_N = \frac{-\alpha(1-\delta)}{1-\alpha}$ and $\mu_T = \frac{-\alpha\delta}{1-\alpha}$.

[15] Whatever the real wage may be in the other sector.

[16] However, monetary policy can cope with strategic interactions based on real variables by altering nominal strategic interactions in a way that counterbalance the real interaction.

It means that a fixed exchange regime is not the best monetary rule, except when the economy is constituted of an extremely small tradable sector. In general, a "managed float" is preferable to a fixed exchange regime.

Proposition 4 *The less open an economy (i.e. the smaller the size of the tradable sector), the less flexible the exchange rate must be in order to prevent the tradable sector to trigger frequent currency depreciation. This argument remains valid for any degree of monetary restrictiveness.*

We can compute the welfare coordination gains obtained by this "optimal" monetary rule (inside the class of monetary rules of zero sum) relative to the maximum possible coordination gains[17], i.e.

$$\frac{\Phi^{opt} - \Phi^{\circ}}{\Phi^{*} - \Phi^{\circ}}.$$

Figure (2) shows this ratio for value of α and δ ranging from 0.1 to 0.9. It has to be compared with figure (1) showing the coordination gains with a fixed exchange regime. As δ tends to 1 (i.e. when the tradable sector becomes infinitely small), the optimal monetary rule corresponds to a fixed exchange regime. Hence, for large δ welfare gains are similar in both graphics. By construction, for δ smaller than 1, the coordination gains with the optimal monetary rule are larger than with a fixed exchange regime.

What is more surprising is that provided α is not too small, the optimal monetary rule yields a large share of all possible coordination gains. It indicates that there is little welfare to be gained by leading more restrictive monetary policy beyond homogeneity of degree 0 of Q with respect to both nominal wages. Hence, the case for further reducing the μ_i parameters is limited.

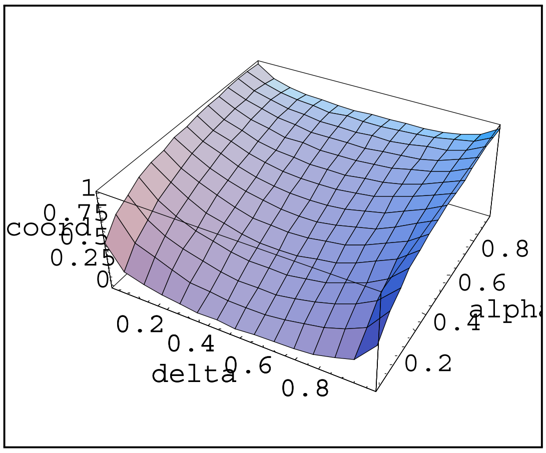

Figure 2: Proportion of possible coordination welfare gains obtained with the optimal monetary rule.

A monetary rule linking the money supply mainly to the relative price of the smallest sector should be the rule rather than the exception. Historically, the attachment of many small open economies (with a relatively small tradable sector) to a fixed exchange rate can be partly

[17] As for figure ??, the ratio is composed of (i) the maximum welfare level (Φ^*) wich is attained with a centralized wage setting; (ii) the non-coordinated welfare level attained without any active monetary rule (Φ°) and (iii) the welfare level obtained with the optimal monetary rule (Φ^{opt}).

explained by the present argument. But other considerations converge towards the same conclusion. For instance, the tradable sectors were in general much more unionized than non-tradable sectors and the wage claims came mainly from these sectors. Therefore, it was important to prevent frequent depreciations by firmly pegging the external value of the national currency.

However the optimal monetary rule seems to be seldom observed. Several explanations can be proposed.

First, this result requires the existence of only two sectors in the economy. In case there are many sub-sectors among broader tradable and non-tradable sectors, monetary policy becomes less effective to keep all sectors under control, unless it becomes very restrictive. Indeed, a monetary rule which links the money supply to many sectorial wages is bound to be globally very restrictive (i.e. homogeneity of Q with respect to all nominal wages (h) becomes very negative) if it wants to have noticeable effects on each relative price. However, this is not necessarily true for tradable sectors. Whatever their number, when their relative price is expressed in foreign currency, the exchange rate determines it (in case tradable sectors are price takers) or influences it (otherwise). That means that there is only one price to be controlled by the Central Bank: monitoring the exchange rate alters the market power of all tradable sectors simultaneously.

Second, the bulk of union strength is generally concentrated in the tradable sector (with a few noticeable exceptions in the non-tradable sector such as the building industry and Public Services). This explains that these sectors are better organized and behave as leader in the wage setting pattern. Therefore, monetary policy mainly focus on the tradable sectors (see Soskice, 1990).

Third, once capital flows are taken into account, a restrictive monetary policy following a nominal wage increase in the non-tradable sector leads in the short run to capital inflows and exchange rate appreciation. This deteriorates the competitiveness of tradable sectors and improves the real wage in the non-tradable sectors. A current account deficit occurs. The aggregate demand effect of the restrictive monetary policy comes only in the medium run. Therefore, the restrictive monetary policy does not reach the desired effect, namely to curtail wage claims in the non-tradable sector, at least in the short or the medium term.

5 Conclusion

The present article deals with the issue of optimal degree of exchange rate flexibility. It departs from the current literature on the subject as it does not introduce nominal rigidities nor address the question of international monetary cooperation. Instead, the argument hinges on the economic structure of the economy.

The existence of sectorial strategic interactions yields a welfare improving opportunity of coordination for monetary policy. Monetary policy can act as a weak-coordinating device by reducing the market power of the price setting agent. This is possible by linking the non-cooperative agents' decision to money supply (through a monetary rule) and nominal aggregate demand. The smaller a sector, the larger its ability to set a high relative price without having to bear the bad consequences of it. As a result, the monetary rule must be more restrictive vis-à-vis small sectors.

This has immediate consequence concerning the choice of an optimal exchange regime in a two sector model. In a very open economy, that is, when the non-tradable sector is small, the monetary rule must mainly link a restrictive monetary policy to the relative price of the non-tradable sector. On the contrary, in a nearly closed economy where the tradable sector represents a small share of national production, a fixed exchange regime becomes more suitable since it allows to keep the relative price of the tradable sector under control by avoiding frequent currency depreciation. For intermediate degree of openness, a semi-flexible exchange rate regime is more suitable.

Though these conclusions are drawn from a very specific framework, the mechanism giving rise to real monetary effects is quite general. On the one hand, independently of the sign of the sectorial spillovers, reducing an agent market power necessarily requires a *restrictive* monetary policy linked to its decisions. On the other hand, in many cases, sectorial size determines the way a sector has to bear the negative consequences of its decisions. Therefore, the main conclusion arguing that a relatively more restrictive monetary reaction is suitable for smaller sectors is likely to remain true in a large number of contexts. However, introducing nominal rigidities could temper this conclusion as a restrictive monetary rule gives rise to (at least short term) output contractions.

Extensions of the present work could introduce the present argument in a richer context including nominal rigidities in the short run. This would make explicit the trade-off between long run structural welfare gains flowing from a restrictive monetary rule and short run welfare lost due to nominal rigidities. In particular, this context would provide a suitable setting to study the credibility of the monetary rule.

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